

MEMS

Sensors & Actuators

2019 Patenting Activity

July 2020



TABLE OF CONTENTS

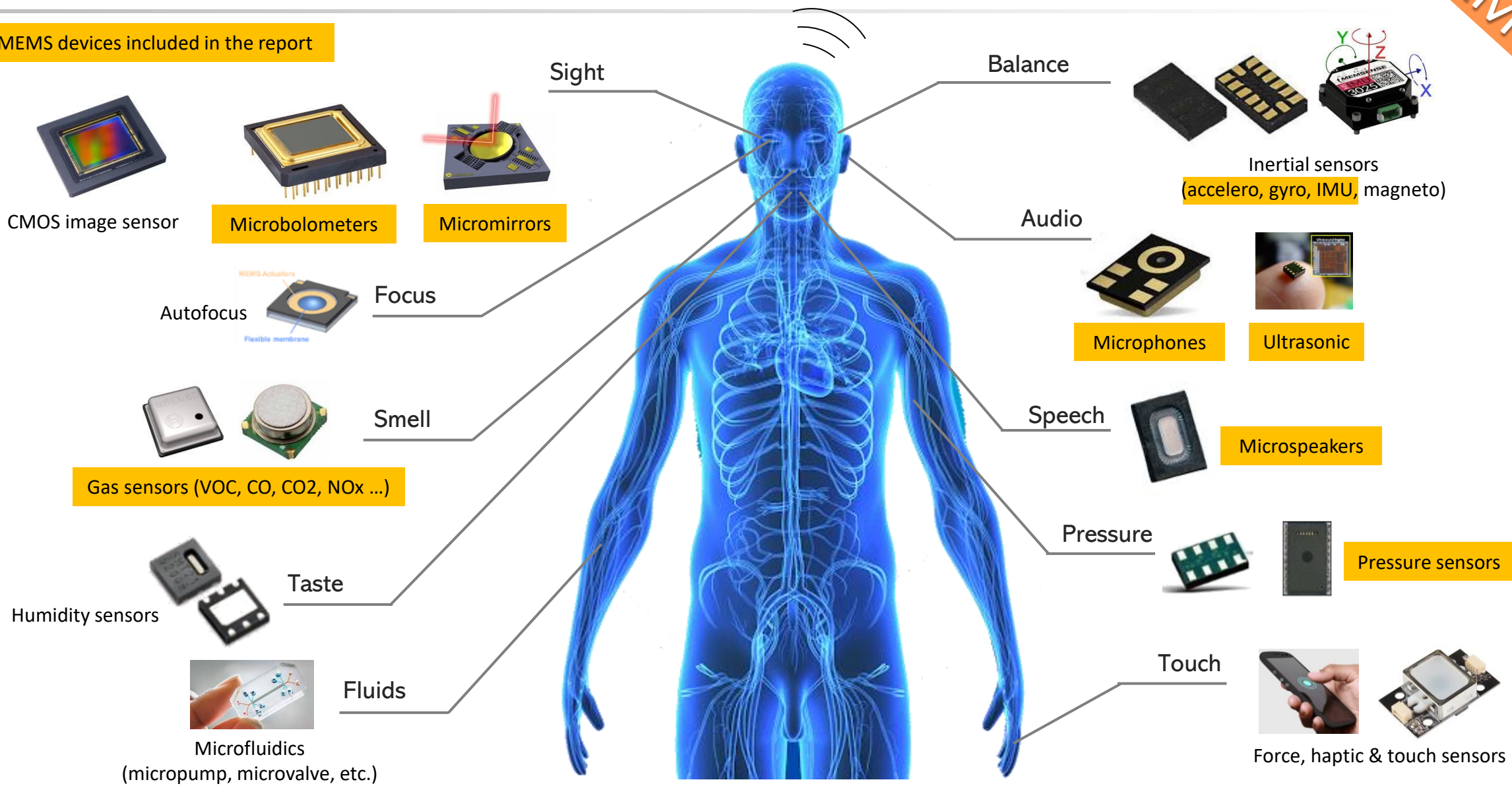
INTRODUCTION	5
MEMS Industry in 2019	
2019 MEMS market players ranking	
MEMS sensors included in the report	
Scope of the report	
Key features of the report	
METHODOLOGY	11
Methodology for patent search and selection	
Terminology for patent analysis	
2019 PATENTING ACTIVITY OVERVIEW	17
Main patent assignees	
Geographic map of patent filings	
Main MEMS devices	
Main IP players per MEMS devices	
IP dynamics and trends	
2019 patenting activity vs. Market growth	
INERTIAL SENSORS	25
Scope of the segment	
Main IP players of 2019	
Summary of 2019 patenting activity	
2019 patenting activity of main players: Seiko Epson, Bosch	
Piezoelectric inertial sensors: Murata, Kyocera, TDK	
Chinese IP players	
ACOUSTIC SENSORS	34
Summary of 2019 patenting activity for Microphones, Microspeakers and Ultrasonic transducers	
For each acoustic sensors:	
Scope of the segment	

Main IP players of 2019	
2019 patenting activity of main players: Goertek, AAC, Infineon, Usonic, STMicroelectronics, Xinwei Acoustics Technology, Aoife Acoustics Technology, OFILM, BOE, LG, InvenSense, etc.	
GAS SENSORS	54
Scope of the segment	
Main IP players of 2019	
2019 patenting activity of main players: Microjet, Infineon, Bosch	
PRESSURE SENSORS	59
Scope of the segment	
Main IP players of 2019	
2019 patenting activity of main players: Bosch, Infineon, Goertek	
MICROMIRRORS	65
Scope of the segment	
Main IP players of 2019	
2019 patenting activity of main players: Hamamatsu Photonics, Bosch, Mitsumi, Stanley, Ricoh	
MEMS PACKAGING	73
Scope of the segment	
Main IP players of 2019	
2019 main IP players per MEMS devices	
Wafer level package	
MEMS and ASIC in a single package	
CONCLUSION	80

SCOPE OF THE REPORT

SAMPLE

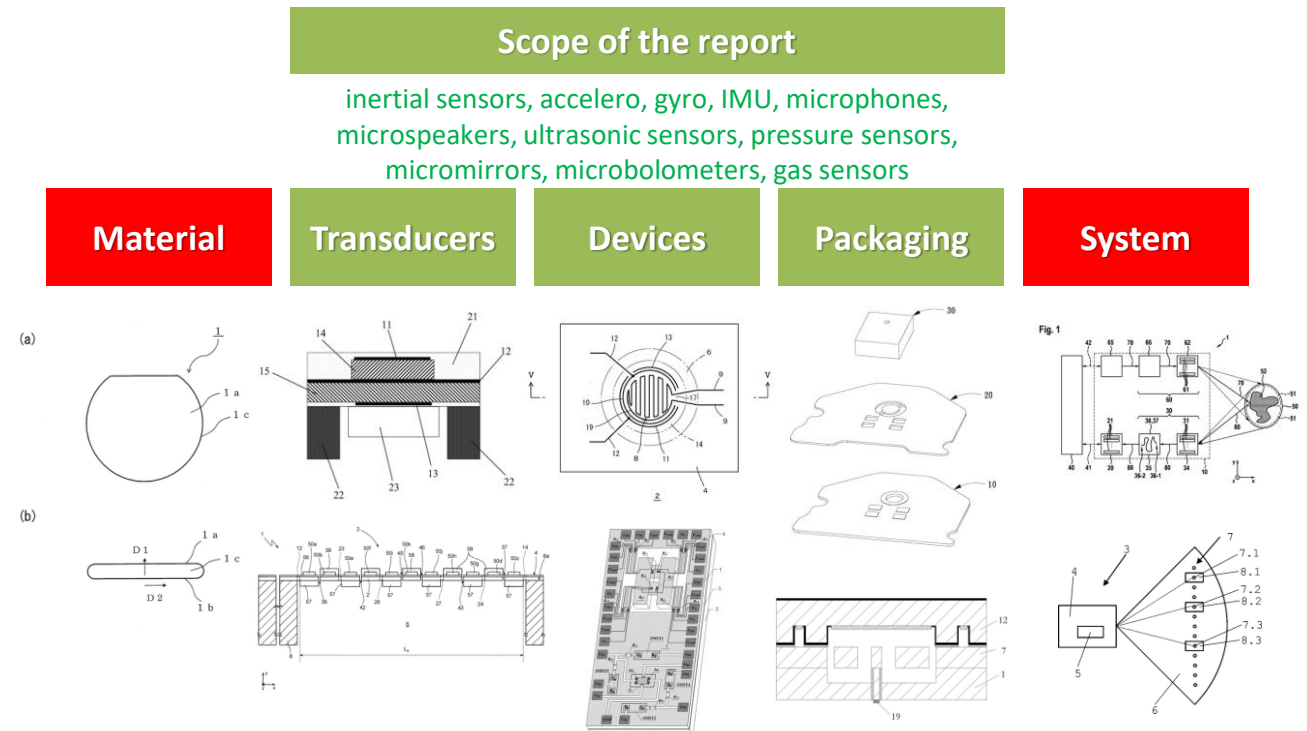
MEMS devices included in the report



celero, gyro, imu),
published in 2019

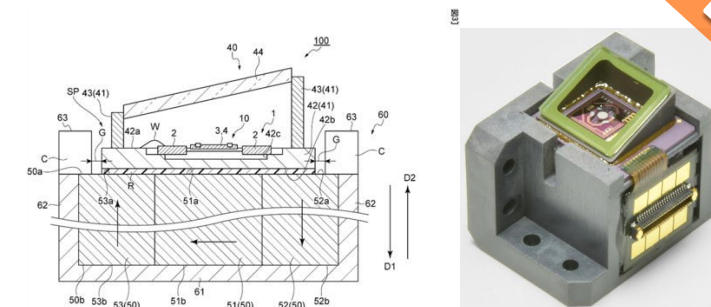
- celero, gyro, imu),
published in 2019

Example of patent	Selected	Not selected
Patents related to MEMS transducers or actuators and with a first publication date in 2019.	X	
Patents related to sensors or actuators, specifically claiming the use of a MEMS process, and with a first publication date in 2019.	X	
Patents related to material growth/deposition, specially developed for MEMS devices, and with a first publication date in 2019.	X	
Patents relates to MEMS technology with a first publication date prior to 2019.		X
Patents related to sensors or actuators which do not use MEMS technology.		X



KEY FEATURES OF THE REPORT

- ✓ The report provides a **global view of the most recent patents published in 2019** by MEMS players, the main **patent applicants**, their IP **collaborations**, an understanding of their **patented technologies** and related R&D developments.
- ✓ Due to the 12-18 months delay between the patent filing and its publication, the **patents published in 2019** give us information on **R&D activity and innovations** that were developed in 2017-2018.
- ✓ The report also provides an extensive **Excel database** with **all patents** analyzed in the report (>4,300 patents), including **application and technology segmentation**. This **useful patent database** allows multi-criteria searches, including dates and numbers of priority/application/publication/grant, title, abstract, claims, patent applicants, current assignees, inventors, hyperlinks to original documents.

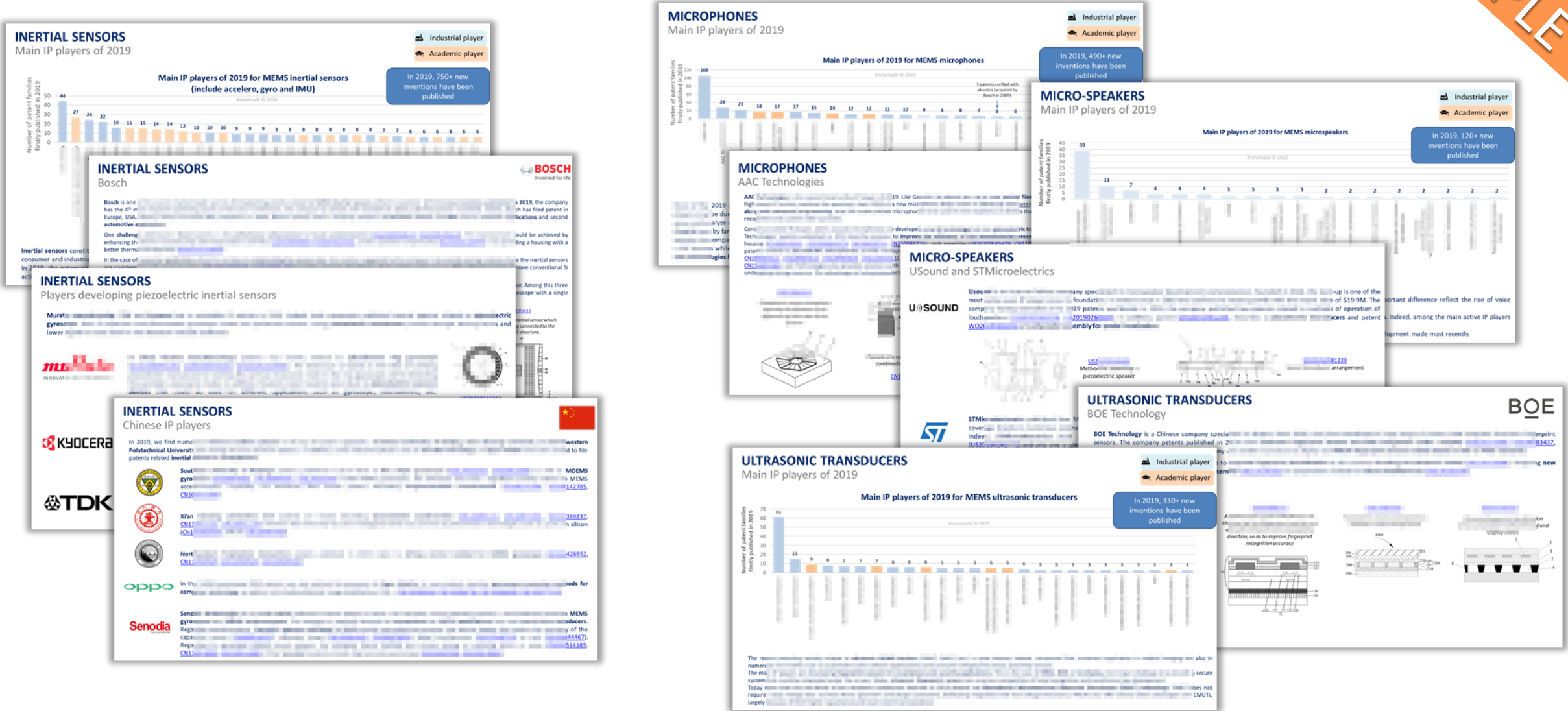


Disclaimer: This report **does not provide** any insight analyses or counsel regarding **legal aspects** or the **validity** of any individual patent. KNOWMADE is a research firm that provides technical analysis and technical opinions. KNOWMADE is not a law firm. The research, technical analysis and/or work proposed or provided by KNOWMADE and contained herein is not a legal opinion and should not be construed as such.

Understanding recent technological development

What are the patented technologies by MEMS devices

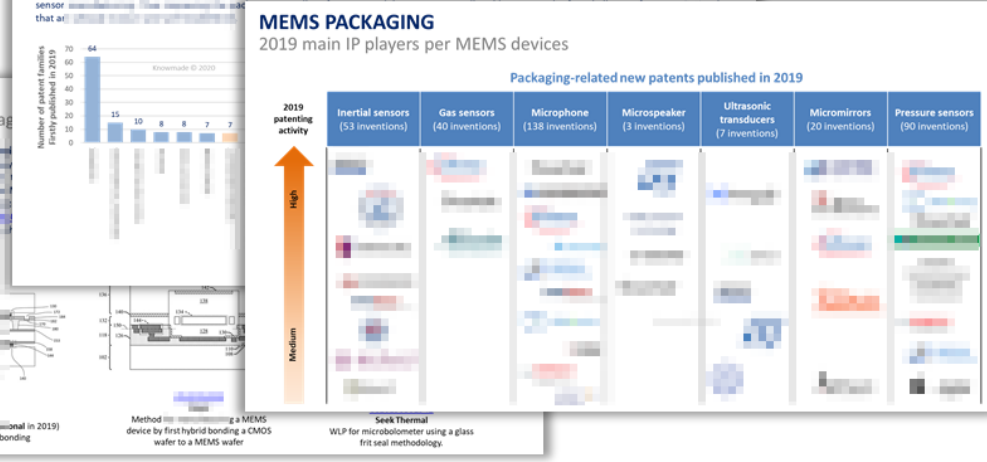
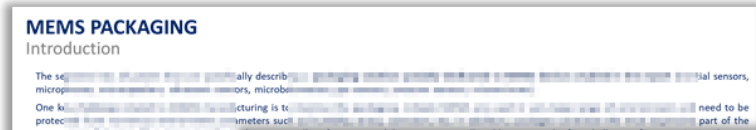
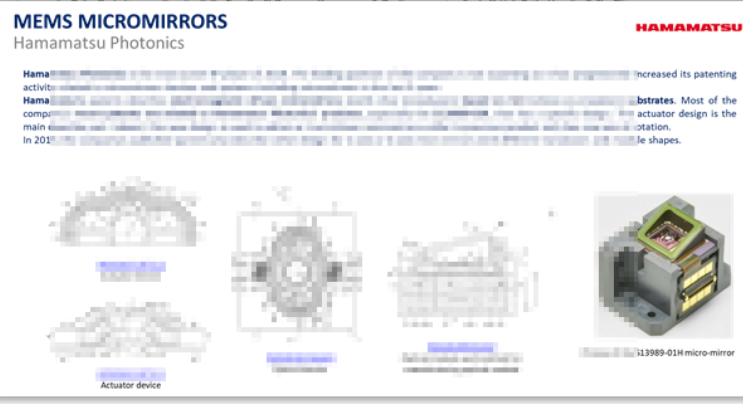
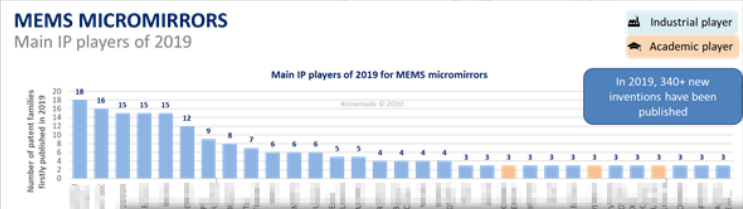
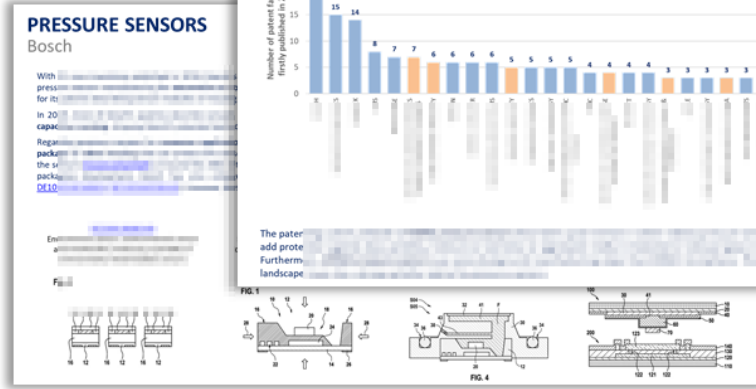
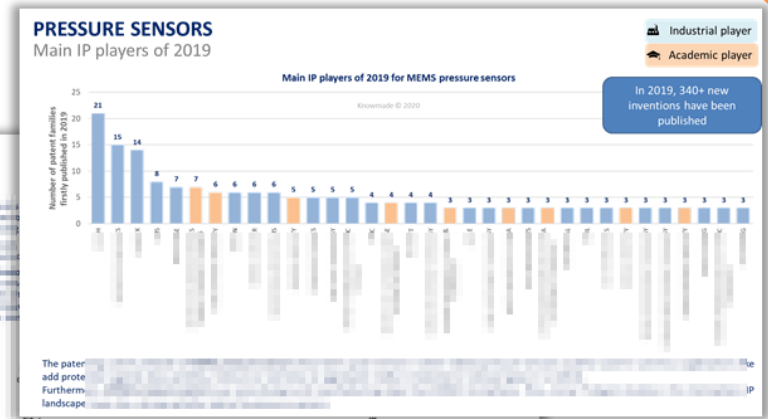
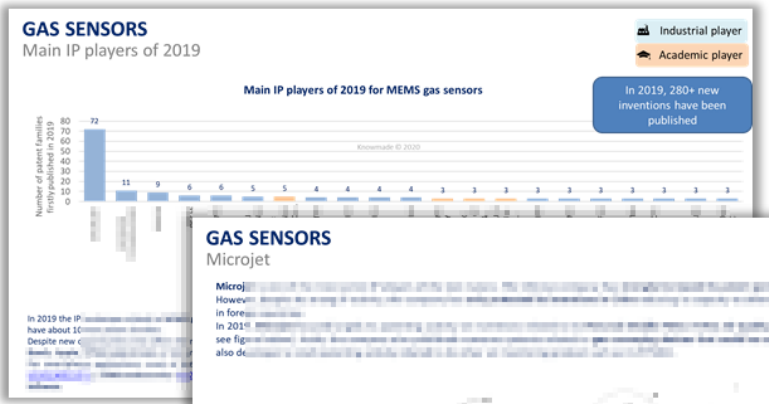
SAMPLE



Understanding recent technological development

What are the patented technologies by MEMS devices

SAMPLE



Patent database

Excel file containing a list of the patents analyzed in this report with corpus segmentation



SAMPLE

This **Excel database** allows multi-criteria searches and includes patent publication number, hyperlinks to the original documents, priority date, title, abstract, patent assignee, legal status and technical segment for each patent families.

MEMS IP ACTIVITY 2019 - June 2020
KnowMade

Quoted unique family ID (FAN)	Publication numbers	Title	Abstract	Earliest application date	Earliest publication date	Expected expiry date	Current assignee	Inventor	Legal status (Pending, Granted, Revoked, Expired, Lapsed)	Original document	Inertial	Accelerometer	Gyroscope	Microphone	Microspeaker	Ultrasonic	Gas sensor	Micromirrors	Pressure sensor	Packaging
8033460	US2008026827	Acoustic biometric touch scanner	An acoustic biometric touch scanner device and method of use. In one aspect, an acoustic fingerprint sensing device is used to scan a user's finger. The device includes a transducer array and a processing unit. The transducer array is configured to receive acoustic signals from a user's finger. The processing unit is configured to process the received signals to generate an acoustic fingerprint. The acoustic fingerprint is then used to identify the user.	2008-04-30	2009-08-22	2017-05-25	LELAND STANFORD JUNIOR UNIVERSITY (US)	ROBERT J. BAKER	GRANTED	Class							X			
8012460	US2010217549	Acoustic biometric touch scanner	An acoustic biometric touch scanner device and method of use. In one aspect, an acoustic fingerprint sensing device is used to scan a user's finger. The device includes a transducer array and a processing unit. The transducer array is configured to receive acoustic signals from a user's finger. The processing unit is configured to process the received signals to generate an acoustic fingerprint. The acoustic fingerprint is then used to identify the user.	2009-04-30	2009-08-22	2017-05-25	STANFORD UNIVERSITY (US)	ROBERT J. BAKER	PENDING	Class							X			
8854936	WO2010055826	Surface stress sensor, hollow structural element, and method	A surface stress sensor, a hollow structural element, and a method of manufacturing the same. The surface stress sensor includes a substrate and a sensor layer. The sensor layer is configured to sense a change in surface stress. The hollow structural element includes a hollow core and a shell. The shell is configured to protect the sensor layer.	2008-09-20	2009-09-28	2021-09-20	ASAR KASEI (EP)	MOCHIZUKA HISAHITO	PENDING	Class										
8854936	JP2009056706	Surface stress sensor and manufacturing method thereof	A surface stress sensor, a hollow structural element, and a method of manufacturing the same. The surface stress sensor includes a substrate and a sensor layer. The sensor layer is configured to sense a change in surface stress. The hollow structural element includes a hollow core and a shell. The shell is configured to protect the sensor layer.	2008-09-20	2009-09-28	2020-09-20	ASAR KASEI (EP)	MOCHIZUKA HISAHITO	PENDING	Class										
8854936	CN111338537	Surface stress sensor, hollow structural element, and method	A surface stress sensor, a hollow structural element, and a method of manufacturing the same. The surface stress sensor includes a substrate and a sensor layer. The sensor layer is configured to sense a change in surface stress. The hollow structural element includes a hollow core and a shell. The shell is configured to protect the sensor layer.	2008-09-20	2009-09-28	2020-09-20	ASAR KASEI (EP)	MOCHIZUKA HISAHITO	PENDING	Class										
8788409	US10008013	Method for fabricating a layered structure using surface	A method for fabricating a layered structure using surface micromachining. The method includes depositing a layer of material on a substrate, patterning the layer, and etching the substrate to form a cavity. The cavity is then filled with a second layer of material, and the process is repeated to form a multi-layered structure.	2009-02-14	2009-06-20	2020-02-14	UNIVERSITY OF BRITISH COLUMBIA (CA)	SHIMON BRIAN B	GRANTED	Class							X			
8788409	US0804612	Method for fabricating a layered structure using surface	A method for fabricating a layered structure using surface micromachining. The method includes depositing a layer of material on a substrate, patterning the layer, and etching the substrate to form a cavity. The cavity is then filled with a second layer of material, and the process is repeated to form a multi-layered structure.	2009-02-14	2009-06-20	2020-02-14	UNIVERSITY OF BRITISH COLUMBIA (CA)	SHIMON BRIAN B	GRANTED	Class							X			
8788409	US0398632	Layered structure and method for fabricating same	A layered structure and a method for fabricating same. The layered structure includes a substrate and a sensor layer. The sensor layer is configured to sense a change in surface stress. The method for fabricating the layered structure includes depositing a layer of material on a substrate, patterning the layer, and etching the substrate to form a cavity. The cavity is then filled with a second layer of material, and the process is repeated to form a multi-layered structure.	2009-02-14	2009-06-20	2020-02-14	UNIVERSITY OF BRITISH COLUMBIA (CA)	SHIMON BRIAN B	GRANTED	Class							X			
8741540	US2010077330	Low cost and high performance bolometer circuitry and	A low cost and high performance bolometer circuitry and method of manufacturing the same. The bolometer circuitry includes a substrate and a sensor layer. The sensor layer is configured to sense a change in resistance. The method of manufacturing the bolometer circuitry includes depositing a layer of material on a substrate, patterning the layer, and etching the substrate to form a cavity. The cavity is then filled with a second layer of material, and the process is repeated to form a multi-layered structure.	2009-08-16	2010-02-05	2020-08-16	FLIR SYSTEMS (US)	SHIMON BRIAN B	PENDING	Class										
87407180	US2010080941	Low cost and high performance bolometer circuitry and	A low cost and high performance bolometer circuitry and method of manufacturing the same. The bolometer circuitry includes a substrate and a sensor layer. The sensor layer is configured to sense a change in resistance. The method of manufacturing the bolometer circuitry includes depositing a layer of material on a substrate, patterning the layer, and etching the substrate to form a cavity. The cavity is then filled with a second layer of material, and the process is repeated to form a multi-layered structure.	2009-08-16	2010-02-05	2020-08-16	FLIR SYSTEMS (US)	SHIMON BRIAN B	PENDING	Class										
87397411	US20100026027	Membrane for increased thermal dissipation	A membrane for increased thermal dissipation. The membrane includes a substrate and a sensor layer. The sensor layer is configured to sense a change in resistance. The method of manufacturing the membrane includes depositing a layer of material on a substrate, patterning the layer, and etching the substrate to form a cavity. The cavity is then filled with a second layer of material, and the process is repeated to form a multi-layered structure.	2009-06-04	2009-12-19	2020-06-04	SLICON LIGHT MACHINES (US)	LEE SAE WON	PENDING	Class										
87397411	WO2010124347	Membrane for increased thermal dissipation	A membrane for increased thermal dissipation. The membrane includes a substrate and a sensor layer. The sensor layer is configured to sense a change in resistance. The method of manufacturing the membrane includes depositing a layer of material on a substrate, patterning the layer, and etching the substrate to form a cavity. The cavity is then filled with a second layer of material, and the process is repeated to form a multi-layered structure.	2009-06-04	2009-12-19	2021-12-15	SLICON LIGHT MACHINES (US)	LEE SAE WON	PENDING	Class										
87521292	IN20182103396	System facilitating characterization of a micro electro-	A system facilitating characterization of a micro electro-mechanical system (MEMS) device and method thereof. The system includes a substrate and a sensor layer. The sensor layer is configured to sense a change in resistance. The method of manufacturing the system includes depositing a layer of material on a substrate, patterning the layer, and etching the substrate to form a cavity. The cavity is then filled with a second layer of material, and the process is repeated to form a multi-layered structure.	2008-06-22	2019-07-27	2028-06-22	INDIAN INSTITUTE OF TECHNOLOGY BOMBAY	CHANDRASEKHAR SURESH	PENDING	Class										
87240758	CA2830261	A system and method of testing deflection conversion for	A system and method of testing deflection conversion for a microelectromechanical system (MEMS) device. The system includes a substrate and a sensor layer. The sensor layer is configured to sense a change in resistance. The method of manufacturing the system includes depositing a layer of material on a substrate, patterning the layer, and etching the substrate to form a cavity. The cavity is then filled with a second layer of material, and the process is repeated to form a multi-layered structure.	2008-06-29	2010-03-29	2028-06-29	MILLER MITCHELL & CO	MILLER MITCHELL & CO	PENDING	Class										
87204411	TW2008007	Microelectromechanical system (MEMS) apparatus with	A microelectromechanical system (MEMS) apparatus with a sensor layer. The sensor layer is configured to sense a change in resistance. The method of manufacturing the MEMS apparatus includes depositing a layer of material on a substrate, patterning the layer, and etching the substrate to form a cavity. The cavity is then filled with a second layer of material, and the process is repeated to form a multi-layered structure.	2009-03-29	2010-03-21	2020-03-29	INDUSTRIAL TECHNOLOGY RESEARCH INSTITUTE	TEH CHEN-RAN	GRANTED	Class										
87197986	IN201911048755	Low power loss air quality monitoring, predicting, and	A low power loss air quality monitoring, predicting, and control system. The system includes a substrate and a sensor layer. The sensor layer is configured to sense a change in resistance. The method of manufacturing the system includes depositing a layer of material on a substrate, patterning the layer, and etching the substrate to form a cavity. The cavity is then filled with a second layer of material, and the process is repeated to form a multi-layered structure.	2009-11-28	2019-11-28	2029-11-28	PRATHE CHATURVEDI	CHATURVEDI PRATHE	PENDING	Class										
87163774	CN200800088	Silicon microphones with high stability	Silicon microphones with high stability. The microphones include a substrate and a sensor layer. The sensor layer is configured to sense a change in resistance. The method of manufacturing the microphones includes depositing a layer of material on a substrate, patterning the layer, and etching the substrate to form a cavity. The cavity is then filled with a second layer of material, and the process is repeated to form a multi-layered structure.	2008-06-22	2009-06-22	2020-06-22	DONGGUAN RUI QIN ELECTRONICS (CN)	CHEN WEIBO	GRANTED	Class					X					
87162192	CN11062754	Linear microelectromechanical transducer sensor array	A linear microelectromechanical transducer sensor array. The array includes a substrate and a sensor layer. The sensor layer is configured to sense a change in resistance. The method of manufacturing the array includes depositing a layer of material on a substrate, patterning the layer, and etching the substrate to form a cavity. The cavity is then filled with a second layer of material, and the process is repeated to form a multi-layered structure.	2009-09-12	2010-09-12	2020-09-12	SHANGHAI JIAO TONG UNIVERSITY	LIU DING	PENDING	Class										
87161172	CN11063573	Biased piezoelectric relaxation free gyroscope and signal	A biased piezoelectric relaxation free gyroscope and signal processing method. The gyroscope includes a substrate and a sensor layer. The sensor layer is configured to sense a change in resistance. The method of manufacturing the gyroscope includes depositing a layer of material on a substrate, patterning the layer, and etching the substrate to form a cavity. The cavity is then filled with a second layer of material, and the process is repeated to form a multi-layered structure.	2009-09-12	2010-09-12	2020-09-12	SHANGHAI JIAO TONG UNIVERSITY	LIU DING	PENDING	Class										
87158128	CN200802087	Silicon microphones with high stability	Silicon microphones with high stability. The microphones include a substrate and a sensor layer. The sensor layer is configured to sense a change in resistance. The method of manufacturing the microphones includes depositing a layer of material on a substrate, patterning the layer, and etching the substrate to form a cavity. The cavity is then filled with a second layer of material, and the process is repeated to form a multi-layered structure.	2009-09-12	2010-09-12	2020-09-12	SHANGHAI JIAO TONG UNIVERSITY	LIU DING	GRANTED	Class										
87151928	CN200802090	Bone conduction silicon microphone	A bone conduction silicon microphone. The microphone includes a substrate and a sensor layer. The sensor layer is configured to sense a change in resistance. The method of manufacturing the microphone includes depositing a layer of material on a substrate, patterning the layer, and etching the substrate to form a cavity. The cavity is then filled with a second layer of material, and the process is repeated to form a multi-layered structure.	2009-09-12	2010-09-12	2020-09-12	DONGGUAN RUI QIN ELECTRONICS (CN)	CHEN WEIBO	GRANTED	Class										
87151158	CN200878186	Pressure sensor packaging structure	A pressure sensor packaging structure. The structure includes a substrate and a sensor layer. The sensor layer is configured to sense a change in resistance. The method of manufacturing the structure includes depositing a layer of material on a substrate, patterning the layer, and etching the substrate to form a cavity. The cavity is then filled with a second layer of material, and the process is repeated to form a multi-layered structure.	2009-09-12	2010-09-12	2020-09-12	SHANGHAI JIAO TONG UNIVERSITY	LIU DING	GRANTED	Class										
87149385	CN11063180	Single-axis inertial platform system based on atomic spin	A single-axis inertial platform system based on atomic spin. The system includes a substrate and a sensor layer. The sensor layer is configured to sense a change in resistance. The method of manufacturing the system includes depositing a layer of material on a substrate, patterning the layer, and etching the substrate to form a cavity. The cavity is then filled with a second layer of material, and the process is repeated to form a multi-layered structure.	2009-09-12	2010-09-12	2020-09-12	SHANGHAI JIAO TONG UNIVERSITY	LIU DING	PENDING	Class										
87147704	CN200878805	Accelerometer	An accelerometer. The accelerometer includes a substrate and a sensor layer. The sensor layer is configured to sense a change in resistance. The method of manufacturing the accelerometer includes depositing a layer of material on a substrate, patterning the layer, and etching the substrate to form a cavity. The cavity is then filled with a second layer of material, and the process is repeated to form a multi-layered structure.	2009-09-12	2010-09-12	2020-09-12	SHANGHAI JIAO TONG UNIVERSITY	LIU DING	GRANTED	Class										
87144773	CN110631616	Ultrahigh-temperature micro optical fiber (EPF) strain sensor	An ultrahigh-temperature micro optical fiber (EPF) strain sensor. The sensor includes a substrate and a sensor layer. The sensor layer is configured to sense a change in resistance. The method of manufacturing the sensor includes depositing a layer of material on a substrate, patterning the layer, and etching the substrate to form a cavity. The cavity is then filled with a second layer of material, and the process is repeated to form a multi-layered structure.	2009-09-12	2010-09-12	2020-09-12	SHANGHAI JIAO TONG UNIVERSITY	LIU DING	PENDING	Class										
87144730	CN110631605	Gyroscope and accelerometer	A gyroscope and accelerometer. The device includes a substrate and a sensor layer. The sensor layer is configured to sense a change in resistance. The method of manufacturing the device includes depositing a layer of material on a substrate, patterning the layer, and etching the substrate to form a cavity. The cavity is then filled with a second layer of material, and the process is repeated to form a multi-layered structure.	2009-09-12	2010-09-12	2020-09-12	SHANGHAI JIAO TONG UNIVERSITY	LIU DING	PENDING	Class										
87144400	CN110631670	System and method for improving temperature stability of	A system and method for improving temperature stability of a microelectromechanical system (MEMS) device. The system includes a substrate and a sensor layer. The sensor layer is configured to sense a change in resistance. The method of manufacturing the system includes depositing a layer of material on a substrate, patterning the layer, and etching the substrate to form a cavity. The cavity is then filled with a second layer of material, and the process is repeated to form a multi-layered structure.	2009-09-12	2010-09-12	2020-09-12	SHANGHAI JIAO TONG UNIVERSITY	LIU DING	PENDING	Class										
87140549	CN110636288	MEMS optical sensor with artificial intelligence detection	A MEMS optical sensor with artificial intelligence detection. The sensor includes a substrate and a sensor layer. The sensor layer is configured to sense a change in resistance. The method of manufacturing the sensor includes depositing a layer of material on a substrate, patterning the layer, and etching the substrate to form a cavity. The cavity is then filled with a second layer of material, and the process is repeated to form a multi-layered structure.	2009-10-12	2010-10-12	2020-10-12	SHANGHAI JIAO TONG UNIVERSITY	LIU DING	PENDING	Class										
87139631	CN110636421	MEMS structure and manufacturing method thereof	A MEMS structure and manufacturing method thereof. The structure includes a substrate and a sensor layer. The sensor layer is configured to sense a change in resistance. The method of manufacturing the structure includes depositing a layer of material on a substrate, patterning the layer, and etching the substrate to form a cavity. The cavity is then filled with a second layer of material, and the process is repeated to form a multi-layered structure.	2009-09-09	2010-09-09	2020-09-09	SHANGHAI JIAO TONG UNIVERSITY	LIU DING	PENDING	Class										
87139623	CN110631669	MEMS single ring resonator vibrating structure	A MEMS single ring resonator vibrating structure. The structure includes a substrate and a sensor layer. The sensor layer is configured to sense a change in resistance. The method of manufacturing the structure includes depositing a layer of material on a substrate, patterning the layer, and etching the substrate to form a cavity. The cavity is then filled with a second layer of material, and the process is repeated to form a multi-layered structure.	2009-10-12	2010-10-12	2020-10-12	SHANGHAI JIAO TONG UNIVERSITY	LIU DING	PENDING	Class										
87138494	CN200802089	Directional output silicon microphone	A directional output silicon microphone. The microphone includes a substrate and a sensor layer. The sensor layer is configured to sense a change in resistance. The method of manufacturing the microphone includes depositing a layer of material on a substrate, patterning the layer, and etching the substrate to form a cavity. The cavity is then filled with a second layer of material, and the process is repeated to form a multi-layered structure.	2009-09-03	2010-09-03	2020-09-03	DONGGUAN RUI QIN ELECTRONICS (CN)	CHEN WEIBO	GRANTED	Class					X					
87137578	CN110627021	Method and system for monitoring process parameters of	A method and system for monitoring process parameters of a microelectromechanical system (MEMS) device. The system includes a substrate and a sensor layer. The sensor layer is configured to sense a change in resistance. The method of manufacturing the system includes depositing a layer of material on a substrate, patterning the layer, and etching the substrate to form a cavity. The cavity is then filled with a second layer of material, and the process is repeated to form a multi-layered structure.	2009-06-22	2010-06-22	2020-06-22	SHANGHAI JIAO TONG UNIVERSITY	LIU DING	PENDING	Class										
87135388	CN110631759	Differential pressure sensor packaging structure	A differential pressure sensor packaging structure. The structure includes a substrate and a sensor layer. The sensor layer is configured to sense a change in resistance. The method of manufacturing the structure includes depositing a layer of material on a substrate, patterning the layer, and etching the substrate to form a cavity. The cavity is then filled with a second layer of material, and the process is repeated to form a multi-layered structure.	2009-09-29	2010-09-29	2020-09-29	SHANGHAI JIAO TONG UNIVERSITY	LIU DING	PENDING	Class										
87134854	CN200878008	MEMS Front account chip	A MEMS Front account chip. The chip includes a substrate and a sensor layer. The sensor layer is configured to sense a change in resistance. The method of manufacturing the chip includes depositing a layer of material on a substrate, patterning the layer, and etching the substrate to form a cavity. The cavity is then filled with a second layer of material, and the process is repeated to form a multi-layered structure.	2009-04-01	2010-04-01	2020-04-01	SHANGHAI JIAO TONG UNIVERSITY	LIU DING	GRANTED	Class										
87132391	CN110631675	Strap-down system based on atomic spin gyroscope	A strap-down system based on atomic spin gyroscope. The system includes a substrate and a sensor layer. The sensor layer is configured to sense a change in resistance. The method of manufacturing the system includes depositing a layer of material on a substrate, patterning the layer, and etching the substrate to form a cavity. The cavity is then filled with a second layer of material, and the process is repeated to form a multi-layered structure.	2009-09-12	2010-09-12	2020-09-12	SHANGHAI JIAO TONG UNIVERSITY	LIU DING	PENDING	Class										
87132348	CN110631668	Novel MEMS device gyroscope based on two-dimensional	A novel MEMS device gyroscope based on two-dimensional atomic spin. The device includes a substrate and a sensor layer. The sensor layer is configured to sense a change in resistance. The method of manufacturing the device includes depositing a layer of material on a substrate, patterning the layer, and etching the substrate to form a cavity. The cavity is then filled with a second layer of material, and the process is repeated to form a multi-layered structure.	2009-09-10	2010-09-10	2020-09-10	SHANGHAI JIAO TONG UNIVERSITY	LIU DING	PENDING	Class										
87132355	CN110631685	Vibration detection device and manufacturing method	A vibration detection device and manufacturing method. The device includes a substrate and a sensor layer. The sensor layer is configured to sense a change in resistance. The method of manufacturing the device includes depositing a layer of material on a substrate, patterning the layer, and etching the substrate to form a cavity. The cavity is then filled with a second layer of material, and the process is repeated to form a multi-layered structure.	2009-09-05	2010-09-05	2020-09-05	SHANGHAI JIAO TONG UNIVERSITY	LIU DING	PENDING	Class										
87132193	CN110632538	Magnetic field acceleration integrated sensor and	A magnetic field acceleration integrated sensor and method of manufacturing the same. The sensor includes a substrate and a sensor layer. The sensor layer is configured to sense a change in resistance. The method of manufacturing the sensor includes depositing a layer of material on a substrate, patterning the layer, and etching the substrate to form a cavity. The cavity is then filled with a second layer of material, and the process is repeated to form a multi-layered structure.	2009-09-20	2010-09-20	2020-09-20	SHANGHAI JIAO TONG UNIVERSITY	LIU DING	PENDING	Class										
87127444	CN110631642	Preparation process of graphene resonant gas sensor based	A preparation process of graphene resonant gas sensor based on atomic spin. The process includes depositing a layer of material on a substrate, patterning the layer, and etching the substrate to form a cavity. The cavity is then filled with a second layer of material, and the process is repeated to form a multi-layered structure.	2009-08-14	2010-08-14	2020-08-14	SHANGHAI JIAO TONG UNIVERSITY	LIU DING	PENDING	Class										
87122290	CN110632078	Silicon microphones	Silicon microphones. The microphones include a substrate and a sensor layer. The sensor layer is configured to sense a change in resistance. The method of manufacturing the microphones includes depositing a layer of material on a substrate, patterning the layer, and etching the substrate to form a cavity. The cavity is then filled with a second layer of material, and the process is repeated to form a multi-layered structure.	2009-09-16	2010-09-16	2020-09-16	SHANGHAI JIAO TONG UNIVERSITY	LIU DING	PENDING	Class										
87119060	CN110631788	Calibration method for gyro and accelerometer sensor	A calibration method for gyro and accelerometer sensor. The method includes depositing a layer of material on a substrate, patterning the layer, and etching the substrate to form a cavity. The cavity is then filled with a second layer of material, and the process is repeated to form a multi-layered structure.	2009-10-30	2010-10-30	2020-10-30	SHANGHAI JIAO TONG UNIVERSITY	LIU DING	PENDING	Class										
87117913	CN200878009	High precision MEMS gyroscope	A high precision MEMS gyroscope. The gyroscope includes a substrate and a sensor layer. The sensor layer is configured to sense a change in resistance. The method of manufacturing the gyroscope includes depositing a layer of material on a substrate, patterning the layer, and etching the substrate to form a cavity. The cavity is then filled with a second layer of material, and the process is repeated to form a multi-layered structure.	2009-09-12	2010-09-12	2020-09-12	SHANGHAI JIAO TONG UNIVERSITY	LIU DING	GRANTED	Class										
87116994	CN200803722	MEMS package structure	A MEMS package structure. The structure includes a substrate and a sensor layer. The sensor layer is configured to sense a change in resistance. The method of manufacturing the structure includes depositing a layer of material on a substrate, patterning the layer, and etching the substrate to form a cavity. The cavity is then filled with a second layer of material, and the process is repeated to form a multi-layered structure.	2009-04-01	2010-04-01	2020-04-01	SHANGHAI JIAO TONG UNIVERSITY	LIU DING	GRANTED	Class										
87116700	CN110631642	Simple supported cantilever beam structure MEMS	A simple supported cantilever beam structure MEMS device. The device includes a substrate and a sensor layer. The sensor layer is configured to sense a change in resistance. The method of manufacturing the device includes depositing a layer of material on a substrate, patterning the layer, and etching the substrate to form a cavity. The cavity is then filled with a second layer of material, and the process is repeated to form a multi-layered structure.	2009-09-19	2010-09-19	2020-09-19	SHANGHAI JIAO TONG UNIVERSITY	LIU DING	PENDING	Class										
87114414	CN200808629	Intelligent microsystem device for electric circuit current	An intelligent microsystem device for electric circuit current detection. The device includes a substrate and a sensor layer. The sensor layer is configured to sense a change in resistance. The method of manufacturing the device includes depositing a layer of material on a substrate, patterning the layer, and etching the substrate to form a cavity. The cavity is then filled with a second layer of material, and the process is repeated to form a multi-layered structure.	2009-03-04	2010-03-04	2020-03-04	SHANGHAI JIAO TONG UNIVERSITY	LIU DING	GRANTED	Class										

Patent information
Patent numbers, application dates, publication dates, current assignee, inventors, current legal status

Segmentation by MEMS devices
Inertial, accelero, gyro, microphone, microspeaker, ultrasonic, gas sensor, micromirror, pressure sensor, packaging

ORDER FORM

MEMS Sensors & Actuators: 2019 Patenting Activity

Patent Landscape Analysis – July 2020

Ref.:KM20005



SHIP TO

Name (Mr/Ms/Dr/Pr):

Job Title:

Company:

Address:

City:

State:

Postcode/Zip:

Country:

VAT ID Number for EU members:

Tel:

Email:

Date:

PAYMENT METHODS

Check

To pay your invoice using a check, please mail your check to the following address:

KnowMade S.A.R.L.
2405 route des Dolines
06560 Valbonne Sophia Antipolis
FRANCE

Money Transfer

To pay your invoice using a bank money wire transfer please contact your bank to complete this process. Here is the information that you will need to submit the payment:

Payee: KnowMade S.A.R.L.
Bank: Banque Populaire Méditerranée, CAP 3000 Quartier du lac, 06700 St Laurent du Var, France
IBAN: FR76 1460 7003 6360 6214 5695 139
BIC/SWIFT: CCBPFRPPMAR

Paypal

In order to pay your invoice via PAYPAL, you must first register at www.paypal.com. Then you can send money to the KnowMade S.A.R.L. by entering our E-mail address contact@knowmade.fr as the recipient and entering the invoice amount.

RETURN ORDER BY

E-mail: contact@knowmade.fr

Mail: KnowMade S.A.R.L., 2405 route des Dolines, 06560 Valbonne Sophia Antipolis, FRANCE

PRODUCT ORDER

☐ €2,990 – Multi user license

For price in dollars, please use the day's exchange rate. For French customer, add 20% for VAT.

All reports are delivered electronically in pdf format at payment reception.

I hereby accept Knowmade's Terms and Conditions of Sale

Signature:

Terms and Conditions of Sales

DEFINITIONS

“Acceptance”: Action by which the Buyer accepts the terms and conditions of sale in their entirety. It is done by signing the purchase order which mentions “I hereby accept Knowmade’s Terms and Conditions of Sale”.

“Buyer”: Any business user (i.e. any person acting in the course of its business activities, for its business needs) entering into the following general conditions to the exclusion of consumers acting in their personal interests.

“Contracting Parties” or “Parties”: The Seller on the one hand and the Buyer on the other hand.

“Intellectual Property Rights” (“IPR”) means any rights held by the Seller in its Products, including any patents, trademarks, registered models, designs, copyrights, inventions, commercial secrets and know-how, technical information, company or trading names and any other intellectual property rights or similar in any part of the world, notwithstanding the fact that they have been registered or not and including any pending registration of one of the above mentioned rights.

“License”: For the reports and databases, 2 different licenses are proposed. The buyer has to choose one license:

1. One user license: a single individual at the company can use the report.

2. Multi user license: the report can be used by unlimited users within the company. Subsidiaries are not included.

“Products”: Reports are established in PowerPoint and delivered on a PDF format and the database may include Excel files.

“Seller”: Based in Sophia Antipolis (France headquarters), Knowmade is a technology intelligence company specialized in the research and analysis of scientific and technical information. We provide patent landscapes and scientific state of the art with high added value to businesses and research laboratories. Our intelligence digests play a key role to define your innovation and development strategy.

1. SCOPE

1.1 The Contracting Parties undertake to observe the following general conditions when agreed by the Buyer and the Seller. Any additional, different, or conflicting terms and conditions in any other documents issued by the buyer at any time are hereby objected to by the seller, shall be wholly inapplicable to any sale made hereunder and shall not be binding in any way on the seller.

1.2 This agreement becomes valid and enforceable between the Contracting Parties after clear and non-equivocal consent by any duly authorized person representing the Buyer. For these purposes, the Buyer accepts these conditions of sales when signing the purchase order which mentions “I hereby accept Knowmade’s Terms and Conditions of Sale”. This results in acceptance by the Buyer.

1.3 Orders are deemed to be accepted only upon written acceptance and confirmation by the Seller, within [7 days] from the date of order, to be sent either by email or to the Buyer’s address. In the absence of any confirmation in writing, orders shall be deemed to have been accepted.

2. MAILING OF THE PRODUCTS

2.1 Products are sent by email to the Buyer:

- within [1] month from the order for Products already released; or

- within a reasonable time for Products ordered prior to their effective release. In this case, the Seller shall use its best endeavours to inform the Buyer of an indicative release date and the evolution of the work in progress.

2.2 Some weeks prior to the release date the Seller can propose a pre-release discount to the Buyer.

The Seller shall by no means be responsible for any delay in respect of article 2.2 above, and including in cases where a new event or access to new contradictory information would require for the analyst extra time to compute or compare the data in order to enable the Seller to deliver a high quality Products.

2.3 The mailing of the Product will occur only upon payment by the Buyer, in accordance with the conditions contained in article 3.

2.4 The mailing is operated through electronic means either by email via the sales department. If the Product’s electronic delivery format is defective, the Seller undertakes to replace it at no charge to the Buyer provided that it is informed of the defective formatting within 90 days from the date of the original download or receipt of the Product.

2.5 The person receiving the Products on behalf of the Buyer shall immediately verify the quality of the Products and their conformity to the order. Any claim for apparent defects or for non-conformity shall be sent in writing to the Seller within 8 days of receipt of the Products. For this purpose, the Buyer agrees to

produce sufficient evidence of such defects.

2.6 No return of Products shall be accepted without prior information to the Seller, even in case of delayed delivery. Any Product returned to the Seller without providing prior information to the Seller as required under article 2.5 shall remain at the Buyer’s risk.

3. PRICE, INVOICING AND PAYMENT

3.1 Prices are given in the orders corresponding to each Product sold on a unit basis or corresponding to annual subscriptions. They are expressed to be inclusive of all taxes. The prices may be reevaluated from time to time. The effective price is deemed to be the one applicable at the time of the order.

3.2 Payments due by the Buyer shall be sent by cheque payable to Knowmade, PayPal or by electronic transfer to the following account:

Banque Populaire Méditerranée, CAP 3000 Quartier du lac, 06700 St Laurent du Var, France

BIC or SWIFT code: CCBPFRPPMAR

IBAN: : FR76 1460 7003 6360 6214 5695 139

To ensure the payments, the Seller reserves the right to request down payments from the Buyer. In this case, the need of down payments will be mentioned on the order.

3.3 Payment is due by the Buyer to the Seller within 30 days from invoice date, except in the case of a particular written agreement. If the Buyer fails to pay within this time and fails to contact the Seller, the latter shall be entitled to invoice interest in arrears based on the annual rate Refi of the «BCE» + 7 points, in accordance with article L. 441-6 of the French Commercial Code. Our publications (report, database, tool...) are delivered only after reception of the payment.

3.4 In the event of termination of the contract, or of misconduct, during the contract, the Seller will have the right to invoice at the stage in progress, and to take legal action for damages.

4. LIABILITIES

4.1 The Buyer or any other individual or legal person acting on its behalf, being a business user buying the Products for its business activities, shall be solely responsible for choosing the Products and for the use and interpretations he makes of the documents it purchases, of the results he obtains, and of the advice and acts it deduces thereof.

4.2 The Seller shall only be liable for (i) direct and (ii) foreseeable pecuniary loss, caused by the Products or arising from a material breach of this agreement

4.3 In no event shall the Seller be liable for:

a) damages of any kind, including without limitation, incidental or consequential damages (including, but not limited to, damages for loss of profits, business interruption and loss of programs or information) arising out of the use of or inability to use the Seller’s website or the Products, or any information provided on the website, or in the Products;

b) any claim attributable to errors, omissions or other inaccuracies in the Product or interpretations thereof.

4.4 All the information contained in the Products has been obtained from sources believed to be reliable. The Seller does not warrant the accuracy, completeness adequacy or reliability of such information, which cannot be guaranteed to be free from errors.

4.5 All the Products that the Seller sells may, upon prior notice to the Buyer from time to time be modified by or substituted with similar Products meeting the needs of the Buyer. This modification shall not lead to the liability of the Seller, provided that the Seller ensures the substituted Product is similar to the Product initially ordered.

4.6 In the case where, after inspection, it is acknowledged that the Products contain defects, the Seller undertakes to replace the defective products as far as the supplies allow and without indemnities or compensation of any kind for labor costs, delays, loss caused or any other reason. The replacement is guaranteed for a maximum of two months starting from the delivery date. Any replacement is excluded for any event as set out in article 5 below.

4.7 The deadlines that the Seller is asked to state for the mailing of the Products are given for information only and are not guaranteed. If such deadlines are not met, it shall not lead to any damages or cancellation of the orders, except for non-acceptable delays exceeding [4] months from the stated deadline, without information from the Seller. In such case only, the Buyer shall be entitled to ask for a reimbursement of its first down payment to the exclusion of any further damages.

4.8 The Seller does not make any warranties, express or implied, including, without limitation, those of saleability and fitness for a particular purpose, with respect to the Products. Although the Seller shall take

reasonable steps to screen Products for infection of viruses, worms, Trojan horses or other codes containing contaminating or destructive properties before making the Products available, the Seller cannot guarantee that any Product will be free from infection.

5. FORCE MAJEURE

The Seller shall not be liable for any delay in performance directly or indirectly caused by or resulting from acts of nature, fire, flood, accident, riot, war, government intervention, embargoes, strikes, labor difficulties, equipment failure, late deliveries by suppliers or other difficulties which are beyond the control, and not the fault of the Seller.

6. PROTECTION OF THE SELLER’S IPR

6.1 All the IPR attached to the Products are and remain the property of the Seller and are protected under French and international copyright law and conventions.

6.2 The Buyer agreed not to disclose, copy, reproduce, redistribute, resell or publish the Product, or any part of it to any other party other than employees of its company. The Buyer shall have the right to use the Products solely for its own internal information purposes. In particular, the Buyer shall therefore not use the Product for purposes such as:

- Information storage and retrieval systems;

- Recordings and re-transmittals over any network (including any local area network);

- use in any timesharing, service bureau, bulletin board or similar arrangement or public display;

- Posting any Product to any other online service (including bulletin boards or the Internet);

- Licensing, leasing, selling, offering for sale or assigning the Product.

6.3 The Buyer shall be solely responsible towards the Seller of all infringements of this obligation, whether this infringement comes from its employees or any person to whom the Buyer has sent the Products and shall personally take care of any related proceedings, and the Buyer shall bear related financial consequences in their entirety.

6.4 The Buyer shall define within its company point of contact for the needs of the contract. This person will be the recipient of each new report in PDF format. This person shall also be responsible for respect of the copyrights and will guaranty that the Products are not disseminated out of the company.

7. TERMINATION

7.1 If the Buyer cancels the order in whole or in part or postpones the date of mailing, the Buyer shall indemnify the Seller for the entire costs that have been incurred as at the date of notification by the Buyer of such delay or cancellation. This may also apply for any other direct or indirect consequential loss that may be borne by the Seller, following this decision.

7.2 In the event of breach by one Party under these conditions or the order, the non-breaching Party may send a notification to the other by recorded delivery letter upon which, after a period of thirty (30) days without solving the problem, the non-breaching Party shall be entitled to terminate all the pending orders, without being liable for any compensation.

8. MISCELLANEOUS

All the provisions of these Terms and Conditions are for the benefit of the Seller itself, but also for its licensors, employees and agents. Each of them is entitled to assert and enforce those provisions against the Buyer.

Any notices under these Terms and Conditions shall be given in writing. They shall be effective upon receipt by the other Party.

The Seller may, from time to time, update these Terms and Conditions and the Buyer, is deemed to have accepted the latest version of these terms and conditions, provided they have been communicated to him in due time.

9. GOVERNING LAW AND JURISDICTION

9.1 Any dispute arising out or linked to these Terms and Conditions or to any contract (orders) entered into in application of these Terms and Conditions shall be settled by the French Commercial Courts of Grasse, which shall have exclusive jurisdiction upon such issues.

9.2 French law shall govern the relation between the Buyer and the Seller, in accordance with these Terms and Conditions.

KNOWMADE

Patent and Technology Intelligence

KNOWMADE PURPOSE

Turning **patents** and **scientific information**
into **business-oriented report** for **decision makers** working in
R&D, Innovation Strategy, Intellectual Property, and Marketing

Competitive landscape | Technology trends | Opportunities / Risks | R&D and IP strategy



Intellectual Property

Innovation Strategy

Assert your patents
Defend your position in
case of licensing/litigation
Evaluate the risks to
infringe patents

Understand, anticipate
and evaluate the
competitive landscape
and current technology
developments

Improve your R&D
and IP strategy
Identify and get
access to external
innovation

MAIN FIELDS OF EXPERTISE

Communication

- RF, microwave, mm-wave
- Datacom & Photonics
- Front end modules
- Antenna & Networks



Advanced Packaging
Innovative Materials
AI & Computing

Energy

- Power electronics
- Batteries & Fuel-cell
- Power management
- PV



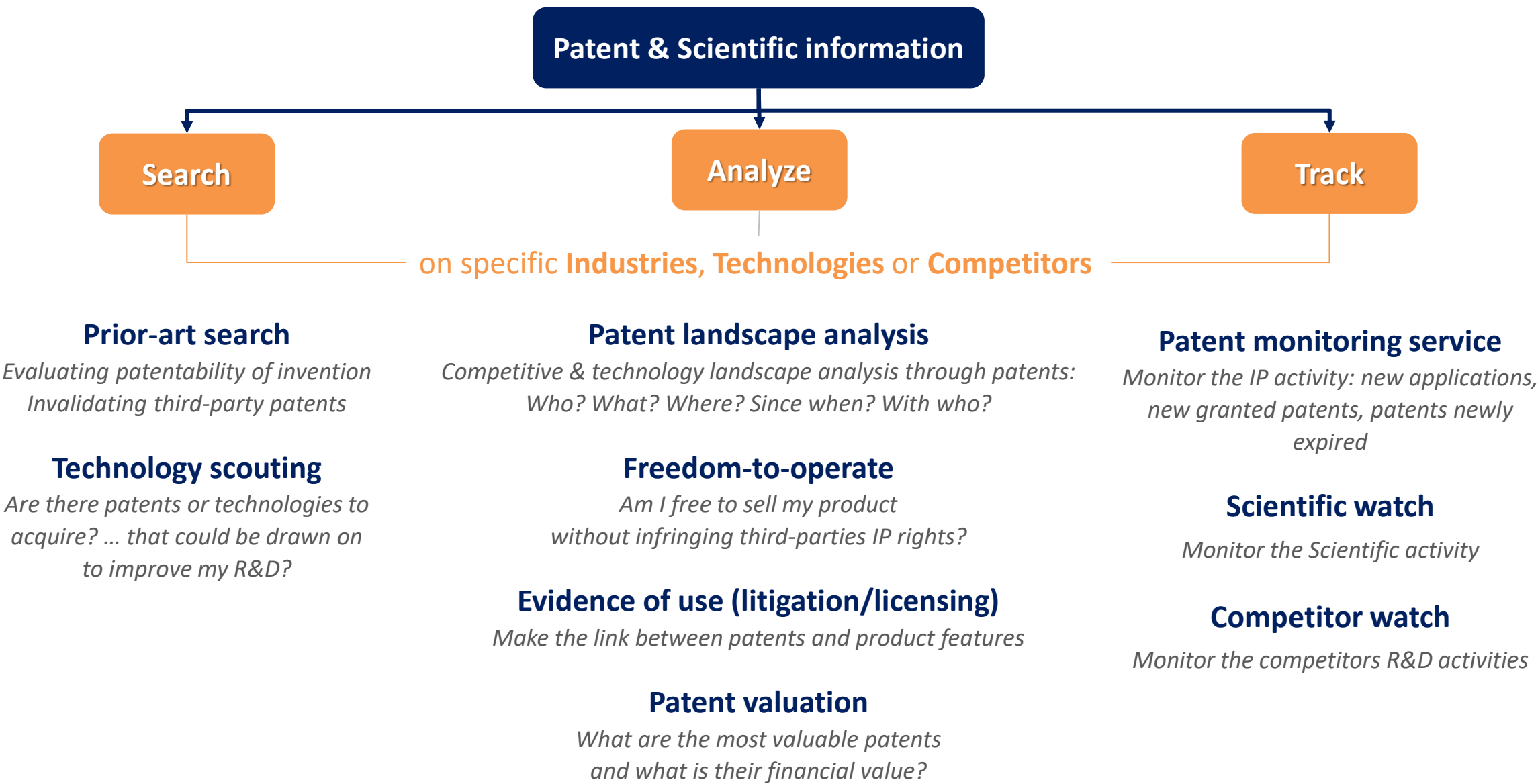
MEMS, Sensors & Optoelectronics

- Micro-systems
- Sensors & Imaging
- Lighting & Display

Life Sciences & Healthcare

- MedTech
- Microfluidics
- Biotech & Pharmaceuticals
- Agrifood

KNOWMADE ACTIVITIES



KNOWMADE OFFER





KnowMade SARL
2405 route des Dolines
06560 Sophia Antipolis, France

www.knowmade.com
contact@knowmade.fr